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(54) Connector for connecting  
cannulae, catheters, flexible  
tubes or the like

(57) In a coupling for medical  
purposes comprising coupling  
members with intercommunicating  
passages and protected from  
contamination through contact by the  
hands, means are provided to close off  
the passage in that coupling member  
which is connected by conduit to the  
patient so as to avoid the entry of air or  
escape of blood if the coupling is

inadvertently undone. The coupling  
members (1, 24) are provided with  
respective interacting internal and  
external conical portions (5, 28). The  
passage of the coupling member (1)  
having the internal conical portion (5)  
contains an elastomeric closure disc (7)  
with a normally closed slit (8). The  
external conical portion (28) of the other  
coupling member (24) is insertable in  
the internal conical portion (5) so that it  
passes at least partially through the slit  
(8) in the disc (7) to permit fluid flow  
through the passages.

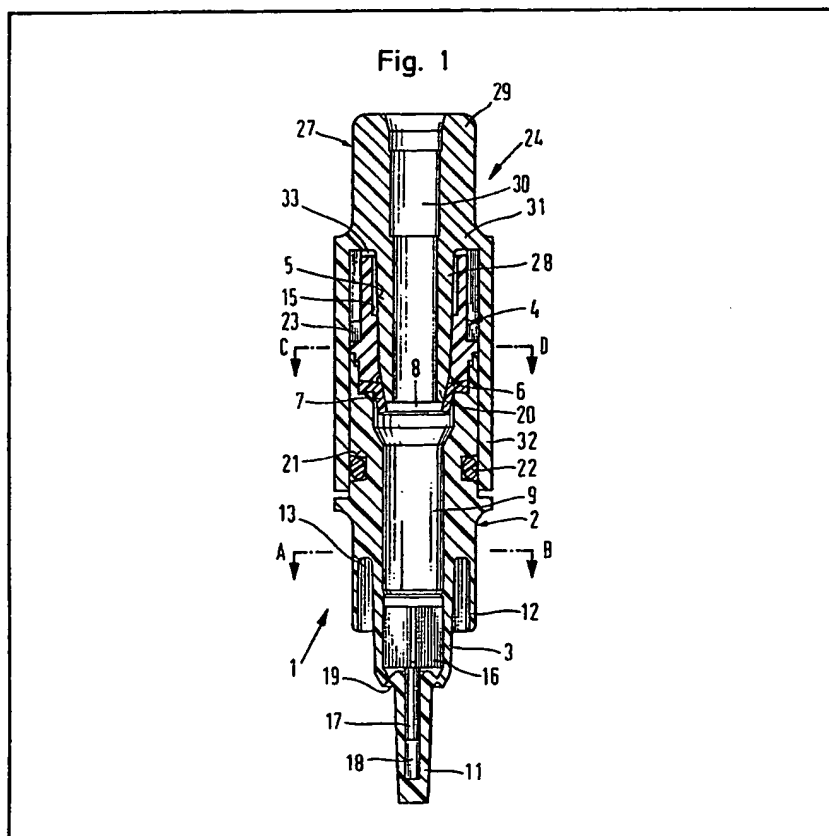


Fig. 1

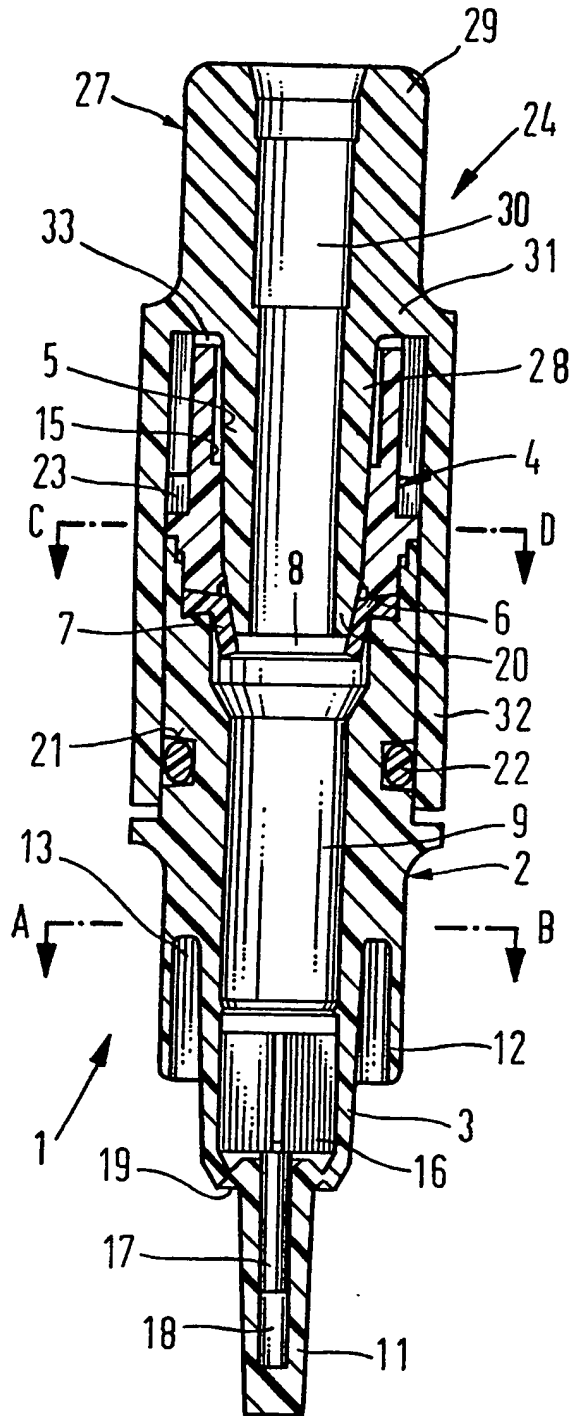


Fig. 3

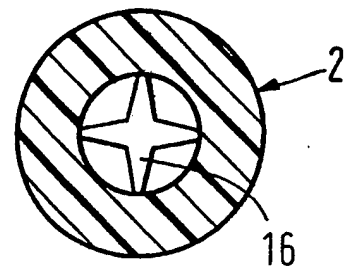


Fig. 2

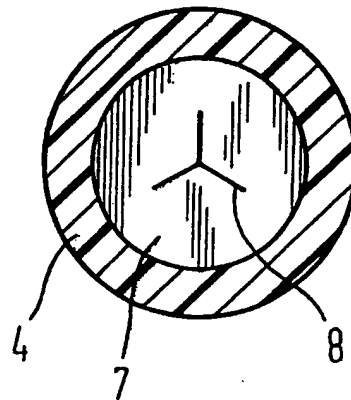


Fig. 4

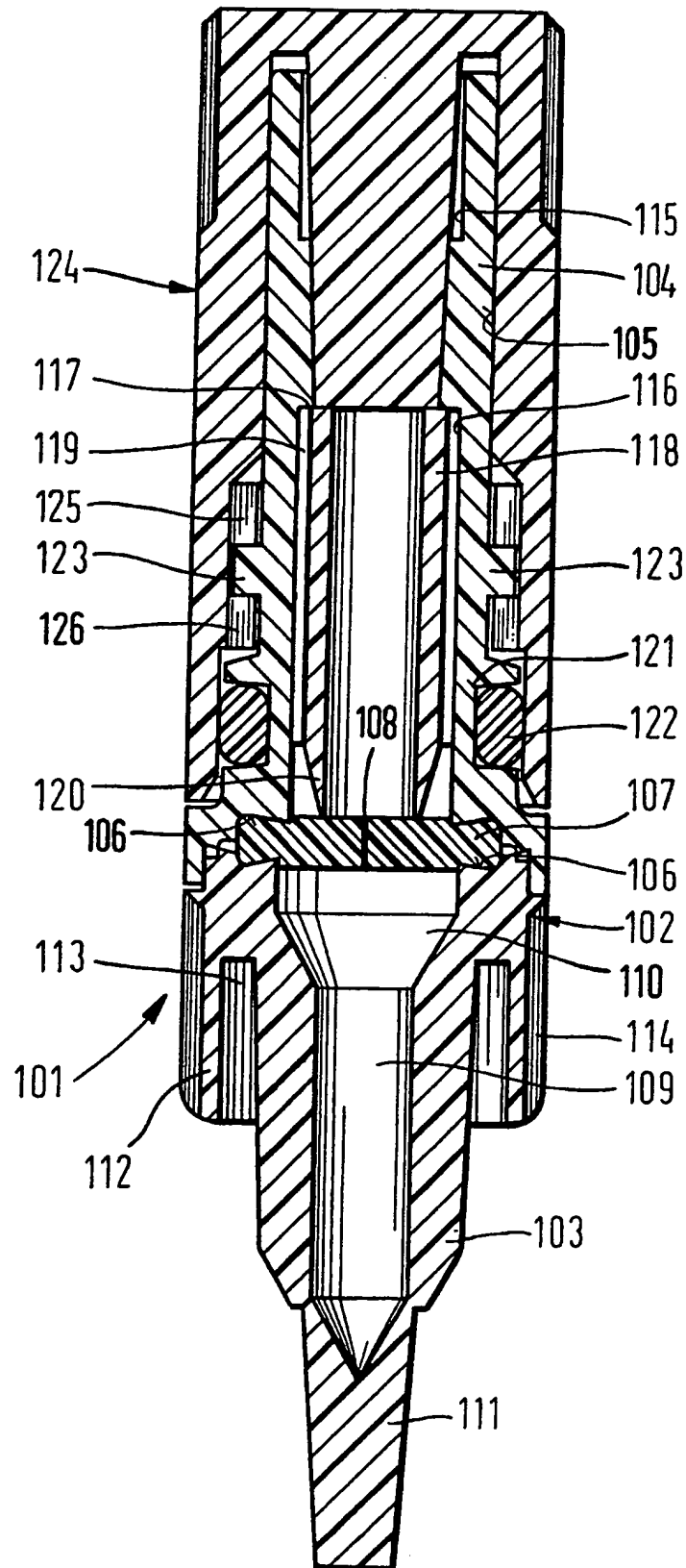
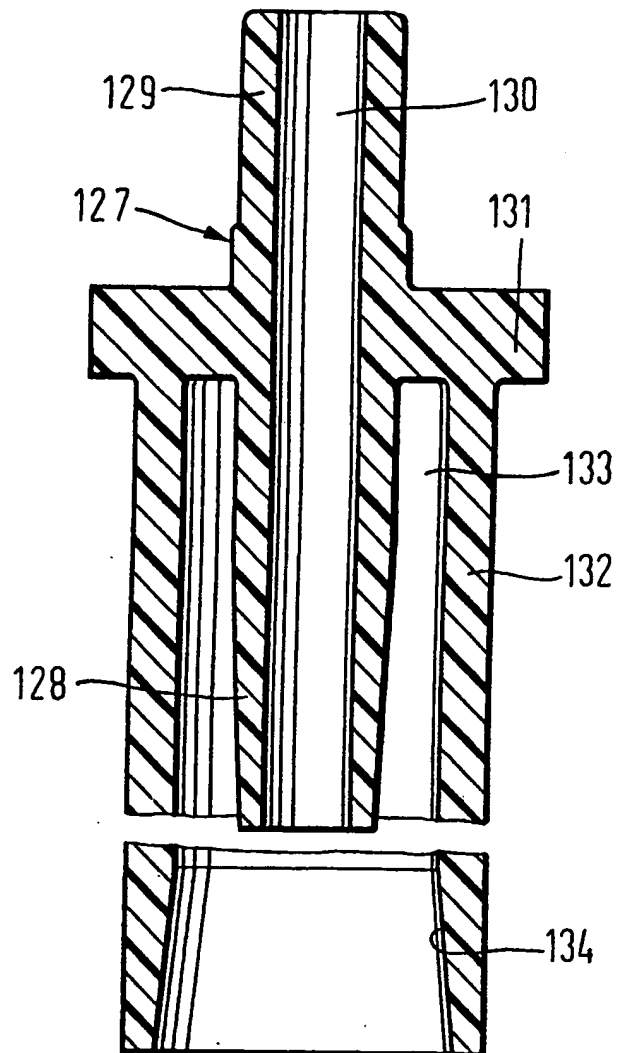


Fig. 5



## SPECIFICATION

**Connector for connecting cannulae, catheters, flexible tubes or the like**

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The invention relates to a connector for the connection of cannulae, catheters, flexible tubes or the like, comprising two coupling members provided with nipples or tubes and adapted to be positively interconnected by a respective external and internal cone thereon.

Such a connector, in which complementary external and internal cones are inserted in one another for the purpose of a sealed connection, is known in the form of a so-called luer connector. When making the connection, however, there is the danger that the parts to be coupled to each other are touched by hand or become unsterile in some other way. Further, air contamination can occur through the entry of air.

In the case of the known connectors, it can also not be guaranteed that the conical coupling members will become unintentionally detached from each other. If the connector is for example used to connect an infusion tube to a vein catheter, there will then be the danger of an air embolism or the escape of blood which could result in bacterial infections during long-term treatments if the disconnection between the infusion tube and the vein catheter remains unnoticed.

It is therefore an object of the present invention to provide a connector of the aforementioned kind in which the coupling members are protected from contamination through contact by the hands or unsterile objects before, during and after making the connection and in which the coupling member communicating with the patient is automatically closed if the connection is inadvertently undone, so that the entry of air or escape of blood will be avoided with certainty.

According to the invention, the inner surface of the through-passage of the first coupling member with the internal cone is provided with a radially circumferential groove in which there is held a valve plate of elastomeric material which blocks the through-passage and has a central slit, that the other coupling member is connected to a protective sleeve which concentrically surrounds the external cone, has an internal diameter larger than the external diameter of the part of the first coupling member which is provided with the internal cone, and is connected to the connecting nipple carrying the external cone to define an annular groove deeper than the length of insertion of the internal cone, and that, when the external cone is in its coupled condition inserted in the internal cone, it passes at least partly through the valve plate to open the slit.

According to a further form of the invention, it is provided that the inner surface of the through-passage of the first coupling member with the internal cone is provided with a radially circumferential groove in which there is held a valve plate of elas-

tomeric material which blocks the throughpassage and has a central slit, that between the valve plate and internal cone there is a guide for a tubular member which is axially displaceable therein, has its front disposed in front of the planar plate in its retracted position and at least partially passes there-through in its projected position to open the slit, that, when the external cone is inserted in the internal cone to be coupled thereto, it projects into the guide by the distance through which the tubular member has to be projected to open the valve plate, and that the other coupling member is connected by way of a collar on the outside of the tube section having the external cone to a protective sleeve which concentrically surrounds said tube section at a spacing and projects thereover. In the connector according to the invention, the conical coupling members are protected from contact by the hand or unsterile objects in that the conical coupling members are on the one hand covered by the protective sleeve and on the other hand disposed in the interior of a tube section. In the coupled condition the coupling members are protected from contamination by the encapsulating protective sleeve. If the coupling is undone or becomes undone, the displaceable member will be in its retracted position in which the slit in the valve plate is closed, so that the associated coupling member is closed by a hermetic and fluid-tight seal. If the connector inadvertently falls apart, the valve plate automatically assumes the closing position in that it pushes the axially displaceable member into its retracted position.

According to a particularly advantageous form of the invention, the tube section pushed into the protective sleeve and having the internal cone is provided with an outer annular groove in which there is inserted an O ring of elastomeric material over which, when the external and internal cone are intercoupled, the protective sleeve engages to deform same elastically. This O ring not only contributes to a better connection between the intercoupled parts but also seals the space between same and the conical connection so that this space can be filled with a disinfectant which remains visible from the outside if the protective sleeve and the coupling members are made of transparent material. It is also impossible for the disinfectant to escape, whereby sterility will be maintained with certainty.

Desirably, the tube section having the internal cone has in its end portion a cylindrical portion which has a diameter larger than the largest diameter of the internal cone and is connected to the internal cone by way of a shoulder. This construction ensures that the internal cone will likewise be disposed within the tube section to such a depth that the hand cannot reach it and it will not become unintentionally contaminated.

In a further form of the invention, before the tube section with the internal cone is coupled, a protective cap is placed on it having a cylindrical portion corresponding to the protective sleeve. Here, again, the O ring maintains the sterility of the inwardly dis-

posed parts of the connector during its production and subsequent storage until it is used. To establish the connection, it is merely necessary to remove the protective cap and replace it with the coupling member having the protective sleeve. Obviously the

- 5 coupling member with the external cone and the protective sleeve can likewise be protected from contamination prior to coupling by means of a cap placed thereon or a closure member.
- 10 The axially displaceable member may be a tube section having ribs uniformly distributed over its periphery and extending along lines on the surface. The member will then be supported on its guide by means of these ribs so that friction will be reduced.
- 15 Further, the part of the member facing the valve plate desirably converges conically so that spreading of the slit in the valve plate will be facilitated by the member making more centrally located engagement.

- 20 Examples of the invention will now be described in more detail with reference to the accompanying drawings, wherein:—

Fig. 1 is a longitudinal section through the coupled coupling members of the connector;

- 25 Fig. 2 is a section on the line C-D in Fig. 1 through the first coupling member having the internal cone; Fig. 3 is a section on the line A-B in Fig. 1 through the first coupling member of the connector having the internal cone;

- 30 Fig. 4 is a longitudinal section through the coupling member with the internal cone in a different embodiment of the connector according to the invention, the protective cap being shown in position, and

- 35 Fig. 5 is a longitudinal section through the coupling member with the external cone and the protective sleeve of the Fig. 4 connector.

- As will be evident from Fig. 1, the coupling member 1 which is provided with the internal cone 5 and, during an infusion, connected to a catheter or cannula leading to the patient comprises a front portion 2 provided with the connecting nipple 3 and a rear portion 4 provided with the internal cone 5, said portions being plugged into each other and welded together. In the assembled condition of the portions 2 and 4, a radially circumferential dovetailed groove 6 is defined in the region of their junction and retains a circular disc-shaped valve plate 7 of elastomeric material provided with a star-shaped slit 8 which terminates in front of the rim of the valve plate 7.

The front portion 2 of the coupling member 1 has a central throughpassage 9 which is of largest diameter in the region of the valve plate 7.

- 55 The connecting nipple 3 onto which a flexible tube can be pushed is provided with a frangible portion 11 which closes the through passage 9. The connecting nipple 3 is conical on the outside so that a connecting tube can be pushed onto it. The connecting nipple 3 is partially surrounded by a tubular member 12 between which and the connecting nipple 3 an annular groove 13 is defined.

- The rear portion 4 is substantially tubular. It comprises a rear cylindrical section 15 which is adjoined by the internally conical portion 5 by way of a shoul-

der.

On the outside of the portion 2 there is a radially circumferential groove 21 in which an O ring 22 of elastomeric material is inserted.

- 70 Lugs 23 forming part of a locking connection are provided on the outside of the portion 4.

- The coupling member 24 is connected to the coupling member 1. The coupling member 24 consists of a tube section 27 which is provided at the front with the coupling external cone 28. The front end of the external cone 28 comprises a conically converging tip 20 which passes partially through the valve plate 7 in the coupled condition. The rear end of the tube section 27 is in the form of a connecting member 29. The tube section 27 comprises a throughpassage 30 which, in the illustrated coupled condition, extends the throughpassage 9 of the coupling member 1.

- The protective sleeve 32 is connected to the tube 27 at 31. Between the protective sleeve 32 and the external cone 28 an annular space 33 is defined in which the tube section with the internal cone 5 is disposed after coupling the coupling members.

- An insert member 16 of star shape in cross-section and connected to an axial guide pin 17 is retained in the throughpassage 9 of the coupling member 1. The guide pin 17 is a press fit in the central recess 18 of the frangible portion 11. The frangible portion 11 is connected to the connecting nipple 3 by the frangible line 19.

- If the frangible portion 11 is separated from the connecting nipple 3 by bending it along the frangible line 19, the guide pin 17 will be pulled so far out of the recess 18 that an annular outlet aperture will be formed.

- As will be evident from Fig. 4, the coupling member 101 which is provided with the internal cone 105 and, during an infusion, is connected to a catheter or cannula leading to the patient comprises a front portion 102 provided with the connecting nipple 103 and a rear portion 104 provided with the internal cone 105, these portions being plugged into each other and welded together. In the assembled condition of the portions 102 and 104, a radially circumferential dovetailed groove 106 is defined at their junction and retains a circular disc-shaped valve plate 107 of elastomeric material provided with a central slit 108 which terminates in front of the rim of the plate 107 at both ends.

- 115 The front portion 102 of the coupling member 101 has a central throughpassage 109 which has its largest diameter in the vicinity of the valve plate 107 and, by means of a frustoconical connecting member in the vicinity of the nipple 103, is reduced to a diameter which corresponds for example to the diameter of a cannula that is to be connected.

- The nipple 103 is provided with a frangible portion 111 which closes the throughpassage 109/110. The connecting nipple 103 is conical on the outside so that a flexible connecting tube can be pushed onto it. The connecting nipple 103 is partially surrounded by a tubular member 112 and an annular groove 113 is defined between this and the connecting nipple 103. The outside of the surrounding tube section 112 is provided with longitudinal grooves 114. For the pur-

pose of connecting a flexible tube, the portion 102 can be securely grasped at the part provided with the longitudinal grooves and the tube can be pushed onto the nipple 103 until its front end is inside the annular groove 113. Optionally, the rear portion of this tube section 112 can be provided with two or four flats or lands which likewise facilitate a good grip.

- The rear portion 104 is substantially tubular. It comprises a rear cylindrical section 115 adjoined by the internally conical portion 105 by way of a shoulder. The internal cone 105 is adjacent the cylindrical guide section 116 of which the diameter is larger than the smallest diameter of the internal cone 105 so that a step 117 is formed at the transition. This step 117 defines an abutment for the tubular member 118 which is axially displaceable in the guide section 116 and is provided on the outside with longitudinally extending ribs 119 distributed at equal spacings over its circumference. The member 118 is supported on the cylindrical wall of the guide section 116 by means of the longitudinally extending ribs 119. The member 118 has a conically converging tip 120 with which it touches the valve plate 107.
- On the outside of the portion 104 there is a radially circumferential groove 121 into which an O ring 122 of elastomeric material is inserted. Further, the outside of the portion 104 is provided with opposed lugs 123 which form parts of a locking connection.
- Optionally, the front of the tube section is provided with a screwthread which produces a secure locking connection to the complementary counter member.

A sleeve-like protective cap 124 is placed on the portion 104 and is provided with two internal helical tracks 125, 126 which co-operate with the lugs 123 to provide the locking connection.

- After removing the protective cap 124, a coupling member with a complementary external cone can be pushed into the internal cone 105 and it will press the axially displaceable member 118 against the valve plate 107 to such an extent that the central slit 108 will be opened and establish communication to the throughpassage 109. The protective sleeve surrounding the external cone is likewise provided with the helical rings of the locking connection so that it can be screwed onto the lugs 123 in the same way as the protective cap until it engages over the O ring 122 which ensures a secure seal.

Fig. 5 illustrates a coupling member with external cone of a different embodiment that can be connected to a coupling member of the Fig. 4 type if it is not provided with the lugs 123 of a locking connection. This coupling member comprises a tube section 127 provided with the coupling external cone 128 at its front end. The rear end of the tube section 127 is in the form of a connecting nipple 129. The tube 127 has a throughpassage 130 which, in the coupled condition, extends the throughpassage 109 of the coupling member shown in Fig. 4.

- The protective sleeve 132 is connected to the tube 127 by way of the collar 131. Between the protective sleeve 132 and the external cone 128 or the tube section 127 there is formed an annular space 133 in which the tube section having the internal cone 105 will be disposed after the other coupling member

has been connected.

Near the front, the protective sleeve 132 is provided with an internal cone 134 to facilitate pushing onto the O ring 122.

## 70 CLAIMS

1. A connector for the connection of cannulae, catheters, flexible tubes or the like, comprising two coupling members provided with nipples or tubes and adapted to be positively interconnected by a respective external and internal cone thereon, wherein the inner surface of the throughpassage of the first coupling member with the internal cone is provided with a radially circumferential groove in which there is held a valve plate of elastomeric material which blocks the throughpassage and has a central slit, that the other coupling member is connected to a protective sleeve which concentrically surrounds the external cone, has an internal diameter larger than the external diameter of the part of the first coupling member which is provided with the internal cone, and is connected to the connecting nipple carrying the external cone to define an annular groove deeper than the length of insertion of the internal cone, and that, when the external cone is in its coupled condition inserted in the internal cone, it passes at least partly through the valve plate to open the slit.
2. The connector of claim 1, wherein the central slit is star-shaped.
3. The connector of claim 1, wherein the part of the first coupling member having the internal cone is provided at its rear portion with a circumferential bead onto which the front portion of the protective sleeve can be pushed.
4. The connector of claim 1, wherein the tube section pushed into the protective sleeve and having the internal cone is provided with an outer annular groove in which there is inserted an O ring of elastomeric material over which, when the external and internal cone are intercoupled, the protective sleeve engages to deform same elastically.
5. The connector of claim 1, wherein the inside of the protective sleeve of the outside of the tube section over which it engages is provided with a screwthread and a mating screwthread or with lugs of a locking connection.
6. The connector of claim 1, wherein the tube section having the internal cone has in its end portion a cylindrical portion with a diameter larger than the smallest diameter of the internal cone and that said cylindrical portion is connected to the internal cone by way of a shoulder.
7. The connector of claim 1, wherein before the tube section with the internal cone is coupled, a protective cap is placed on it having a cylindrical portion corresponding to the protective sleeve.
8. The connector of claim 1, wherein the first coupling member is provided on the side opposite the internal cone with a closed frangible member which is in the form of an extension joined by a frangible point and, after breaking inside a flexible conduit, opens a flow aperture.
9. The connector of claim 8, wherein an insert member bounding flow apertures is disposed in the throughpassage of the first coupling member, which

Insert member has a central pin of flexible material which is a press fit in an axial recess of the frangible member, has a diameter less than the diameter of the throughpassage at the frangible point and is inserted in the axial recess at least to an extent substantially corresponding to the diameter of the frangible member at the frangible point.

10. The connector of claim 1, wherein an insert member bounding flow apertures is disposed in the throughpassage of the first coupling member, which insert member has a central pin of flexible material which is a press fit in an axial recess of the frangible member, has a diameter less than the diameter of the throughpassage at the frangible point and projects beyond the frangible point to an extent that, on bending, the broken-off portion is pulled down by the guide pin but cannot be flushed back in front of the aperture.

11. A connector for the connection of cannulae, catheters, flexible tubes or the like, comprising two coupling members provided with nipples or tubes and adapted to be positively interconnected by a respective external and internal cone thereon, wherein the inner surface of the through passage of the first coupling member with the internal cone is provided with a radially circumferential groove in which there is held a valve plate of elastomeric material which blocks the throughpassage and has a central slit, that between the valve plate and internal cone there is a guide for a tubular member which is axially displaceable therein, has its front disposed in front of the planar plate in its retracted position and at least partially passes therethrough in its projected position to open the slit, that, when the external cone is inserted in the internal cone to be coupled thereto, it projects into the guide by the distance through which the tubular member has to be projected to open the valve plate, and that the other coupling member is connected by way of a collar on the outside of the tube section having the external cone to a protective sleeve which concentrically surrounds said tube section at a spacing and projects thereover.

12. The connector of claim 11, wherein the tube section pushed into the protective sleeve and having the internal cone is provided with an outer annular groove in which there is inserted an O ring of elastomeric material over which, when the external and internal cone are intercoupled, the protective sleeve engages to deform same elastically.

13. The connector of claim 11 or claim 12, wherein the inside of the protective sleeve or the outside of the tube section over which it engages is provided with a screwthread and a mating screwthread or with lugs of a locking connection.

14. The connector of claim 11, wherein the tube section having the internal cone has in its end portion a cylindrical portion with a diameter larger than the smallest diameter of the internal cone and that said cylindrical portion is connected to the internal cone by way of a shoulder.

15. The connector of claim 11, wherein, before the tube section with the internal cone is coupled, a protective cap is placed on it having a cylindrical

portion corresponding to the protective sleeve.

16. The connector of claim 11, wherein axially displaceable member is a tube section having ribs uniformly distributed over its periphery and extending along lines on the surface.

17. The connector of claim 11, wherein the part of the member facing the valve plate converges conically.

18. A connector for the connection of cannulae, catheters, flexible tubes or the like, substantially as hereinbefore described with reference to Figures 1 to 3 or Figures 4 and 5 of the accompanying drawings.

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